

**CLAIMS**

1. Device (1) for sterilizing at least partly formed packages (6) in a packaging machine, said device (1) comprises an inner chamber (2) and an outer chamber (3), the inner chamber (2) being provided with a sterilization unit (5) for sterilizing at least the inside of at least one partly formed package (6), the device (1) further comprises a carrier unit (10) comprising at least one separating member (11) and at least one package carrying member (12), the carrier unit (10) being adapted to rotate between a first position in which said at least one package carrying member (12) is located in the outer chamber (3) and adapted to return and receive at least one package (6), and in which said at least one separating member (11) separates the inner chamber (2) from the outer chamber (3), and a second position in which the carrier unit (10) has rotated and displaced said at least one package (6) into the inner chamber (2) and in which said at least one separating member (11) separates the inner chamber (2) from the outer chamber (3), and the device (1) further comprises means for providing a relative motion between the package (6) and the sterilizing unit (5) for bringing them to a position in which the sterilizing unit (5) is located at least partly in the package (6) for treating it.
2. The device (1) according to claim 1, wherein the inner and outer chambers (2, 3) form a housing (4), and the carrier unit (10) is rotatably connected to said housing (4).
3. The device (1) according to claim 1, wherein the relative motion between the package (6) and the sterilizing unit (5) involves the package (6) moving towards the sterilizing unit (5) to surround it.
4. The device (1) according to claim 1, wherein the outer chamber (3) is provided with a package opening (8) for entrance and exit of packages (6) to and from the device (1).
5. The device (1) according to claim 1, wherein the separating member (11) is substantially shaped as a plate, and the carrying member (12) comprises two substantially disc-shaped members, both being perpendicularly arranged in relation to the separating member (11).

6. The device (1) according to claim 5, wherein the disc-shaped members each being non-rotatably connected to a respective end portion of the separating member (11).
- 5 7. The device (1) according to claim 5, wherein the two disc-shaped members are provided with at least one throughgoing opening (15) each, the openings (15) being aligned with each other.
8. The device (1) according to claim 7, wherein the carrying member (12) is  
10 provided with holding means (16) being aligned with the openings (15).
9. The device (1) according to claim 1, wherein the inner chamber (2) comprises a first and a second chamber portion (2a, 2b).
- 15 10. The device (1) according to claim 9, wherein the sterilizing unit (5) is located in said first chamber portion (2a), and wherein the carrying member (12), in the second position, is located in said second chamber portion (2b) so that the openings (15) in the carrying member (12) are adapted to be aligned with the  
20 sterilizing unit (5), so that the package (6) can be displaced to the position in which the sterilizing unit (5) is located at least partly in the package (6) for treating it.
11. The device (1) according to claims 4 and 7, wherein the carrying member (12), in the first position, is adapted to be positioned so that the openings (15) are  
25 aligned with the package opening (8) in the housing (4), so that the package (6) can enter and exit the device (1).
12. The device (1) according to claim 4, wherein it is adapted to raise the package (6) through the package opening (8) in the housing (4) and into the  
30 carrying member (12) when the carrying member (12) is in the first position, rotate the carrying member (12) to the second position, raise the package (6) to a position in which it at least partly surrounds the sterilizing unit (5), sterilize the package (6) with the sterilizing unit (5), lower it back to the carrying member (12), rotate the carrying member (12) back to the first position, and lower the package  
35 (6) out of the carrying member (12) and out of the package opening (8) in the housing (4).

13. The device (1) according to claim 12, wherein it comprises first displacing means (17) adapted to raise the package (6) from the carrying member (12) to a position in which the package (6) at least partly surrounds the sterilizing unit (5) and adapted to lower the package (6) back to the carrying member (12).

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14. The device (1) according to claim 12, wherein it comprises second displacing means (20) adapted to raise the package (6) through the package opening (8) and into the carrying member (12) and adapted to lower the package (6) out of the carrying member (12) and out of the package opening (8) in the housing (4).

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15. The device (1) according to any of the preceding claims, wherein the carrier unit (10) comprises at least a first and a second carrying member (12a, 12b), at least one at either side of the separating member (11), so that the first carrying member (12a) is adapted to rotate and displace a first package (6) from the first position to the second position at the same time as the second carrying member (12b) is adapted to rotate and displace a second package (6) from the second position to the first position.

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16. The device (1) according to claim 15, wherein it is adapted to raise a first package (6) through the package opening (8) in the housing (4) and into the first carrying member (12a), the first carrying member (12a) being in the first position, and at the same time lower a second package (6) from a position in which it at least partly surrounds the sterilizing unit (5) down to the second carrying member (12b), the second carrying member (12b) being in the second position.

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17. The device (1) according to claim 15, wherein it is adapted to lower a first package (6) from the first carrying member (12a) out through the package opening (8) in the housing (4), the first carrying member (12a) being in the first position, and at the same time raise a second package (6) from the second carrying member (12b), the second carrying member (12b) being in the second position, to a position in which the second package (6) at least partly surrounds the sterilizing unit (5).

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18. The device (1) according to claim 1, wherein the sterilizing unit (5) is an electron beam emitter.

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19. The device (1) according to claim 18, wherein the sterilizing unit (5) comprises more than one electron beam emitter.

20. The device (1) according to any of the preceding claims, wherein the carrying member (12) is adapted to carry more than one package (6).

5 21. The device (1) according to claim 1, wherein the inner chamber (2) is being provided with a gaseous fluid supply (27), the outer chamber (3) being in connection with an outer housing (24) via a package opening (8), the outer housing (24) at least partly surrounding a package conveyor (9) and being provided with a gaseous fluid outlet (26), said outlet (26) being located in a  
10 portion of the outer housing (24) that is being arranged from the package opening (8) in a direction opposite the direction of travel of the package conveyor (9), the supply (27) and the gaseous fluid outlet (26) are adapted to create a flow of a gaseous fluid from the inner chamber (2), through the carrier unit (10), through the outer chamber (3), through the package opening (8) in the housing (4) to the  
15 outer housing (24), and through at least a portion of the outer housing (24) in a direction towards the gaseous fluid outlet (26).

22. The device (1) according to claim 1, wherein the inner chamber (2) is being provided with a gaseous fluid outlet (36), the outer chamber (3) being in  
20 connection with an outer housing (24) via a package opening (8), the outer housing (24) at least partly surrounding a package conveyor (9) and being provided with gaseous fluid supplies (32, 35), at least one of which is being located in a portion of the outer housing (24) that is being arranged from the package opening (8) in a direction being the direction of travel of the package  
25 conveyor (9), and at least one of which being located in a portion of the outer housing (24) that is being arranged from the package opening (8) in a direction opposite the direction of travel of the package conveyor (9), the outlet (36) and the gaseous fluid supplies (32, 35) are adapted to create a flow of a gaseous fluid towards the package opening (8) in the housing (24), through the opening (8) and  
30 into the outer chamber (3), through the carrier unit (10), and through the inner chamber (2) to the gaseous fluid outlet (36).

23. Method for sterilizing at least partly formed packages (6) in a packaging machine, the method comprising the steps of:  
35 providing an inner chamber (2) and an outer chamber (3),  
arranging a sterilizing unit (5) in the inner chamber (2) for sterilizing at least the inside of at least one package (6),

providing a carrier unit (10) comprising at least one separating member (11) and at least one package carrying member (12),

providing rotation of the carrier unit (10) between a first position in which said at least one package carrying member (12) is located in the outer chamber (3) and in which said at least one separating member (11) separates the inner chamber (2) from the outer chamber (3), and a second position in which the package carrying member (12) is located in the inner chamber (2) and in which the separating member (11) separates the inner chamber (2) from the outer chamber (3), and

providing a relative movement between the package (6) and the sterilizing unit (5) for bringing them to a position in which the sterilizing unit (5) is located at least partly in the package (6) for treating it.

24. Method according to claim 23, wherein it comprises the steps of:

raising the package (6) through the package opening (8) in the housing (4) and into the carrying member (12) when the carrying member (12) is in the first position,

rotating the carrying member (12) to the second position,

raising the package (6) to a position in which it at least partly surrounds the sterilizing unit (5),

sterilizing the package (6) with the sterilizing unit (5),

lowering it back to the carrying member (12),

rotating the carrying member (12) back to the first position, and

lowering the package (6) out of the carrying member (12) and out of the package opening (8) in the housing (4).

25. Method according to claim 23, wherein it comprises the steps of:

raising at least one first package (6) through the package opening (8) in the housing (4) and into the first carrying member (12a), the first carrying member (12a) being in the first position, and at the same time lowering a sterilized second package (6) from a position in which it at least partly surrounds the sterilizing unit (5) down to the second carrying member (12b), the second carrying member (12b) being in the second position,

rotating the carrier unit (10) so that the first carrying member (12a) with the first package (6) is rotated from the first position to the second position at the same time as rotating the second carrying member (12b) with the second package (6) from the second position to the first position,

lowering the sterilized second package (6) from the second carrying member (12b) out through the package opening (8) in the housing (4), and at the same time raising the first package (6) from the first carrying member (12a), being located inside the inner chamber (2), to a position in which the first package (6) at least partly surrounds the sterilizing unit (5), and  
5 sterilizing the first package (6).

26. Method according to any of claims 23-25, wherein the sterilizing unit (5) is an electron beam emitter.

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27. Method according to claim 23, comprising the steps of:

providing the inner chamber (2) with a gaseous fluid supply (27),  
providing the outer chamber (3) in connection with an outer housing (24) via a package opening (8), the outer housing (24) at least partly surrounding a package conveyor (9) and being provided with a gaseous fluid outlet (26), said  
15 outlet (26) being located in the portion of the outer housing (24) that is being arranged from the package opening (8) in a direction opposite the direction of travel of the package conveyor (9),  
creating a flow of the gaseous fluid from the inner chamber (2), through the  
20 outer chamber (3), through the package opening (8) in the housing (4) to the outer housing (24), and through at least a portion of the outer housing (24) in a direction towards the gaseous fluid outlet (26).

28. Method according to claim 23, comprising the steps of:

25 providing the inner chamber (2) with a gaseous fluid outlet (36),  
providing the outer chamber (3) in connection with an outer housing (24) via a package opening (8), the outer housing (24) at least partly surrounding a package conveyor (9) and being provided with gaseous fluid supplies (32, 35), at least one of which is being located in a portion of the outer housing (24) that is  
30 being arranged from the package opening (8) in a direction being the direction of travel of the package conveyor (9), and at least one of which being located in a portion of the outer housing (24) that is being arranged from the package opening (8) in a direction opposite the direction of travel of the package conveyor (9),  
creating a flow of the gaseous fluid towards the package opening (8) in the  
35 housing (4), through the opening (8) and into the outer chamber (3), through the carrier unit (10), and through the inner chamber (2) to the gaseous fluid outlet (36).